

Medicine & Science in Sports & Exercise

Issue: Volume 42(5) Supplement 1, May 2010, p 166

Copyright: ©2010The American College of Sports Medicine

Publication Type: [C-17 Thematic Poster - Physiologic and Cognitive Stress in Physically Demanding Occupations: JUNE 3, 2010 8:00 AM - 10:00 AM: ROOM: 330]

DOI: 10.1249/01.MSS.0000384934.57237.67

ISSN: 0195-9131

Accession: 00005768-201005001-00531

[C-17 Thematic Poster - Physiologic and Cognitive Stress in Physically Demanding Occupations: JUNE 3, 2010 8:00 AM - 10:00 AM: ROOM: 330]

## Firefighters' Physiological Responses to Boot Weight and Sole Flexibility During Ladder Climbing and Obstacle Crossing: 1119: Board #3 8:00 AM - 10:00 AM

Turner, Nina L.<sup>1</sup>; Chiou, Sharon<sup>2</sup>; Zwiener, Joyce<sup>2</sup>; Weaver, Darlene<sup>2</sup>; Haskell, William<sup>1</sup>

### Author Information

<sup>1</sup>National Institute for Occupational Safety and Health, Pittsburgh, PA. <sup>2</sup>National Institute for Occupational Safety and Health, Morgantown, WV.

Email: NTurner@cdc.gov

(No disclosure reported)

Firefighter boots may be composed of rubber, lighter leather, or ultralight fabric. Boot soles can be stitched (less flexible) or cemented or bonded (more flexible). A five to 12% increase in oxygen consumption per kg of weight added to the foot has been observed; however, this increase may depend on boot weight and sole type.

**PURPOSE:** To determine the effects of fabric/stitched sole (FS), leather/stitched sole (LS), leather/cement sole (LF) and rubber/bonded sole (RF) boots on firefighters' metabolic and respiratory variables during simulated firefighting tasks.

**METHODS:** Fourteen women and 14 men, wearing full turnout clothing and equipment and one of four pairs of boots, climbed up and down a 3.7-m ladder for five minutes at 25 rungs per minute and then walked for five minutes at 0.57 m·sec<sup>-1</sup> while stepping over four obstacles and carrying a 9.5-kg hose. Minute ventilation (VE), oxygen consumption (VO<sub>2</sub> and VO<sub>2</sub>/kg), CO<sub>2</sub> production (VCO<sub>2</sub>), and heart rate (HR) were measured, and minute-five data were used for analysis. Comparisons of boot weight and sole type were made using ANOVA with repeated measures.

**RESULTS:** During ladder climbing, boot weight had a significant effect ( $P < 0.05$ ) on VE, VO<sub>2</sub> and VCO<sub>2</sub> (\*). There were significant effects ( $P < 0.05$ ) of both boot weight and sole type for VO<sub>2</sub>/kg (\*\*). During obstacle crossing, boot weight had a significant effect ( $P < 0.05$ ) on VE, VO<sub>2</sub> and VO<sub>2</sub>/kg (\*). There were significant effects ( $P < 0.05$ ) of both boot weight and sole type for VCO<sub>2</sub> (\*\*).

**CONCLUSION:** There were significant effects of boot weight (4 - 6% increases per kg increase in boot weight) during both ladder climbing and obstacle crossing, which were mitigated by sole type for VO<sub>2</sub>/kg (2% decrease, ladder climbing) and VCO<sub>2</sub> (6% decrease, obstacle crossing).

Boot (n = 28)	Boot Weight (kg)	VE (L/min)	VO <sub>2</sub> (L/min)	VCO <sub>2</sub> (L/min)	VO <sub>2</sub> /kg (ml/kg/min)	HR (bpm)
<i>Ladder</i>						
FS	2.3	47.3*	1.72*	1.32*	21.7**	157
LS	2.7	48.4*	1.79*	1.38*	22.3**	158
LF	2.8	49.5*	1.76*	1.36*	21.9**	160
RF	3.6	50.6*	1.81*	1.40*	22.5**	158
<i>Obstacle</i>						
FS	2.3	50.3*	1.66*	1.36**	21.1*	158
LS	2.7	50.6*	1.70*	1.38**	21.7*	158
LF	2.8	50.2*	1.65*	1.32**	21.0*	161
RF	3.6	53.4*	1.73*	1.41**	22.0*	161

TABLE. No caption available

IMAGE GALLERY

Select All

 Export Selected to PowerPoint

Boot (n = 28)	Boot Weight (kg)	VE (L/min)	VO <sub>2</sub> (L/min)	VCO <sub>2</sub> (L/min)	VO <sub>2</sub> /kg (ml/kg/min)	HR (bpm)
<i>Ladder</i>						
FS	2.3	47.3*	1.72*	1.32*	21.7**	157
LS	2.7	48.4*	1.79*	1.38*	22.3**	158
LF	2.8	49.5*	1.76*	1.36*	21.9**	160
RF	3.6	50.6*	1.81*	1.40*	22.5**	158
<i>Obstacle</i>						
FS	2.3	50.3*	1.66*	1.36**	21.1*	158
LS	2.7	50.6*	1.70*	1.38**	21.7*	158
LF	2.8	50.2*	1.65*	1.32**	21.0*	161
RF	3.6	53.4*	1.73*	1.41**	22.0*	161

TABLE. No caption av...

[Back to Top](#)

Copyright (c) 2000-2014 Ovid Technologies, Inc.

[Terms of Use](#) | [Support & Training](#) | [About Us](#) | [Contact Us](#)

Version: OvidSP\_UI03.11.00.120, SourceID 59447